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Meteorological reconnaissance flights

By R. J. Ogden

Summary

An informal account, based largely on pilot reminiscences, is given of meteorological reconnaissance flights from the United Kingdom during and shortly after the Second World War.

Introduction

This note is an attempt to set down some recollections of meteorological reconnaissance flights (which used to be referred to colloquially as 'Met Recce' flights) from the point of view of a pilot. It is based primarily on conversations during May 1984 with Captain D. H. ('Bill') Mackie, formerly of British Airways, but also includes some material culled from other sources. The routes followed by the various reconnaissance flights were given code-names, and these are illustrated in Fig. 1.

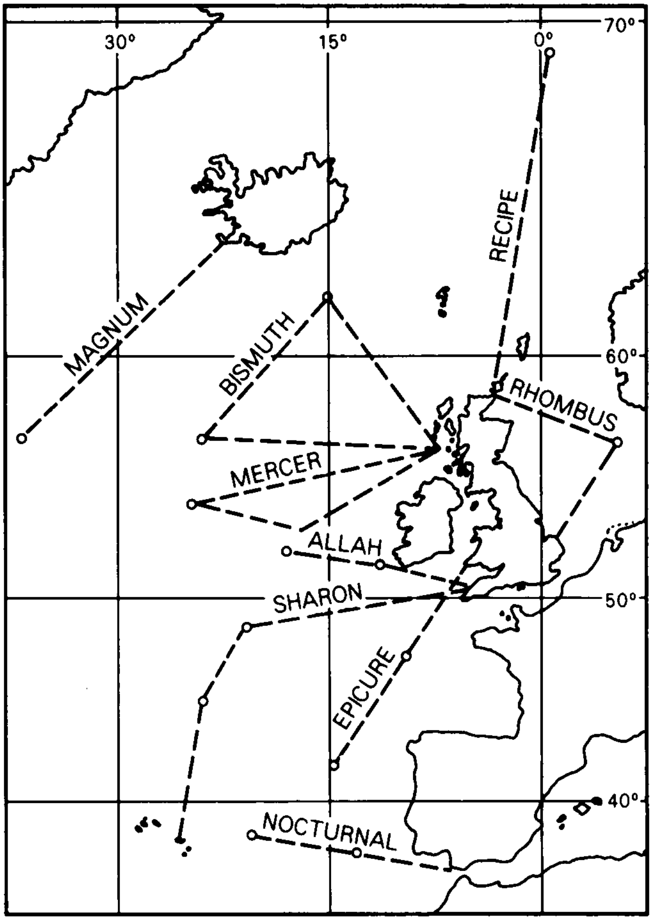

Figure 1. Tracks of meteorological reconnaissance flights in September 1944.

Bill Mackie joined 518 Squadron at Tiree in August 1944, serving as a co-pilot for three months, but thereafter as captain on the BISMUTH and MERCER meteorological reconnaissance flights. Apart from a short detachment to Wick, flying RECIPE flights whilst the squadron there converted from Fortress to Halifax aircraft, he remained at Tiree until August 1945 when the squadron there was moved to Aldergrove to continue the BISMUTH flights from there. In March 1946 he left 518 Squadron, at first remaining at Aldergrove as Commander of the Communications Flight, then moving to St. Eval for a spell as Adjutant of 210 Squadron which was based there for general reconnaissance and air-sea rescue duties. In November 1948 he agreed to return to Aldergrove as Flight Commander of B Flight, 202 Squadron. By this time, 202 Squadron had taken over the BISMUTH flights as its major responsibility, although it also had a subsidiary role in air-sea rescue, when necessary dropping Lindholme gear — self-inflating rubber dinghies equipped with rations, wireless, and so on. Bill Mackie continued with the BISMUTH flights until March 1951, by then having completed some four years and over 1700 hours flying on these duties — probably more than any other RAF pilot. He was awarded the AFC for this work.

On leaving the RAF, Bill Mackie joined BEA (later British Airways), flying several different types of aircraft until his retirement as Captain in 1977. Throughout this time he maintained his interest in aviation meteorology, and in 1976 received an award from the Director-General for long and meritorious service in providing meteorological reports from civil aircraft (see *Meteorol Mag*, **107**, 1978, 97–98).

Aircraft and crews

During 1944, 518 Squadron was equipped with Halifax V aircraft, fitted with Merlin engines; these were gradually replaced by the Halifax III, fitted with Hercules engines. In late 1950, these in turn were replaced by Hastings.

The Halifax bomber was designed to be operated by a crew of seven, namely: captain, navigator, flight engineer, wireless operator, bomb aimer and two air gunners. For meteorological reconnaissance flights the aircraft were unarmed, so the gunners and bomb aimer were not needed. It was decided that, instead, a second pilot and second wireless operator should be added to the crew, plus the meteorological observer. The second pilot occupied a collapsible seat from which he could assist the captain, for example with control of the throttles during take-off, but the aircraft could not be flown independently from his position. The second wireless operator was used only as a relief and no second working position was provided. The meteorological observer occupied the front turret, which offered a wide view for observing purposes.

The Halifax was not pressurized, so the use of oxygen was essential during high-level flight. Normal climb speed was 140 kn and the cruising speed was 165 kn. Cabin heating arrangements were very primitive. There was no de-icing equipment; a paste was applied to the leading edges of the wings before take-off, but in practice this was far from effective. Modifications to the aircraft to fit them for meteorological reconnaissance work included changes to the turret canopies (in the absence of guns), the installation of the co-pilot's seat and the provision of a radio altimeter for use by the captain in addition to his normal pressure altimeter. Appropriate meteorological instruments (e.g. external thermometers, aneroid barometer connected to a static vent) were fitted for use by the meteorological observer, who was also provided with a radar altimeter for accurate height determination at standard and other pressure levels.

From the pilot's point of view, the Hastings was in several ways an improvement on the Halifax. Although a civil version of the Hastings (known as the Hermes and flown by BOAC during the 1950s) had a tricycle undercarriage and was fully pressurized, the meteorological reconnaissance squadron Hastings still had the traditional tail wheel and were not pressurized. However, they did have de-icing equipment, a higher cruising speed of 185 kn, somewhat better cabin heating and much-improved seating arrangements. The co-pilot had a proper seat alongside the captain and, although the instrument panel was not duplicated, the aircraft could be flown from that position. The modifications to the Hastings aircraft for meteorological reconnaissance work were carried out at Radlett.

Flight procedures

The flights from Tiree and, later, Aldergrove took anything from a minimum of seven hours to nine hours or more, and required prolonged concentration on the part of the captain. By late 1944, both BISMUTH and MERCER flights were on triangular tracks, each leg being some 400 to 500 nautical miles. Routine meteorological observations (cloud, temperature, weather, icing, height of pressure surface, etc.) were made every 50 nautical miles (i.e. at about 20-minute intervals); winds were computed by the navigator.

After take-off the aircraft climbed to 950 mb. The meteorological observer advised the captain when this pressure level was reached; thereafter the captain maintained flight at this pressure level by flying at a constant indicated altitude on his pressure altimeter, the sub-scale being left unchanged. Every 150 nautical miles (i.e. roughly every hour), with the aid of the radio altimeter, the aircraft was brought down to 50 ft above the sea to enable a reliable estimate of mean-sea-level pressure to be made.

At the end of the first leg (i.e. some 500 nautical miles from base), after descending to 50 ft for a mean-sea-level pressure check, the aircraft climbed, using a series of short legs on alternating reciprocal headings; at appropriate standard pressure levels the aircraft was levelled out for a minute or so to allow time for the thermometer to stabilize and so permit determination of an accurate vertical temperature profile. The climb continued in this way to the 500 mb level, oxygen masks being put on at 10 000 ft.

The second leg was flown at 500 mb and at the end of this the aircraft descended to 50 ft above the sea, using short reciprocal-heading legs as on the climb. The final leg home was similar to the first leg, i.e. at 950 mb, but with descents to 50 ft above the sea every 150 nautical miles.

The navigator maintained an air plot throughout the trip. GEE fixes could be obtained only near base and the main navigational aid was loran. However, the wireless operator was able from time to time to obtain bearings by W/T from certain land stations in the United Kingdom and thus provide some additional fixes to help the navigator, who computed winds and passed them to the meteorological observer. On the low-level runs, smoke floats were sometimes dropped to enable winds to be derived by observing drift.

In addition to obtaining W/T fixes, the wireless operator transmitted the meteorological information in the form of coded messages after every third routine meteorological observation, i.e. at roughly hourly intervals; during the War years the messages had to be encyphered before transmission. A continuous listening watch was maintained throughout the rest of the time.

From August 1944 until after VE Day, two BISMUTH and two MERCER flights were operated each day from Tiree, one flight on each track being made at night. Subsequently the night flights were dropped, and with the move to Aldergrove the MERCER flights ceased altogether; from then on, at least until 1951, the commitment at Aldergrove was for one daylight BISMUTH flight each day.

General recollections

It was a point of honour that flights would take off if humanly possible, no matter how bad the weather was, and the regularity of the operational sorties was outstanding. For example, during the period from August 1944 to June 1945 at Tiree, only one or two of the scheduled four flights per day were cancelled for weather reasons (personal communication from Fred Gee who was a meteorological air observer with 518 Squadron during this time).

By definition the flights were sent out to enable weather to be observed, and it was not infrequently far from clear in advance exactly what weather would be experienced; some of this proved to be very bad, indeed hazardous, especially during night flights. Because of the lack of de-icing equipment, airframe icing was a particular problem with the Halifax aircraft. On occasions (e.g. 10 February 1945) aircraft were struck by lightning. Turbulence was also a notable and unwelcome feature of the 950 mb legs during the winter because, all too frequently, cumulus and cumulonimbus clouds seemed to have their bases at or near this level, so the aircraft was constantly being bounced up and down.

The sorties had to be flown on standard tracks, using standard flight procedures which had been designed to enable as much useful meteorological information as possible to be obtained from each flight. This program called for a high degree of flying discipline and, inevitably, the constant repetition of routine manoeuvres during long flights, day after day, led to more than a little boredom on the part of the pilot.

Clearly the captain had overriding responsibility for the safety of the aircraft and its crew, and in the event of trouble he had to decide if and when it became essential to modify the standard flight procedures or even to abort the flight. Enemy action was not a problem to meteorological reconnaissance aircraft operating from Tiree. But the flight tracks went far out over the Atlantic where there was no possibility of making an emergency landing, and the chances of successful air-sea rescue if forced to ditch far from home were slender.

The most worrying part of the flight from the captain's point of view was the climb from 50 ft to 500 mb at the end of the first leg. The aircraft was then at its maximum distance from base (about 500 nautical miles) and, after three hours or so flying at low level, the engines were called upon to produce more or less sustained full power for the climb. The likelihood of engine failure was at a maximum at this stage of the flight and there were often the added problems of airframe and engine icing. For example, on one occasion, after the aircraft had managed to reach 10 000 ft, airframe icing became so severe that even the relatively unladen aircraft was brought down to 4000 ft before level flight could be maintained. A different type of icing was responsible for serious trouble on the first operational sortie using the Hastings aircraft (see below).

Two especially hazardous flights

In retrospect after more than 35 years, two flights in particular stand out as examples of the sort of extreme difficulties that could occur.

During the climb at the end of the first leg in a Halifax aircraft, at about 10 000 ft there was a muffled bang followed by an immediate yaw to starboard. The same thing happened again two minutes later. By then oil pressure on the starboard outer engine had fallen to zero and use of the feathering button had no effect at all. Increased drag was apparent and, although the aircraft continued to fly, it was immediately decided that the sortie would have to be aborted. After what must have seemed a very long leg, the aircraft was landed successfully at Aldergrove, and it was then found that a large part of the engine nacelle and fairings was completely missing. Subsequent investigation by AIB established the cause of the accident as the explosion of two fire bottles set off by displacement of part of the primitive cabin heating system so that certain pipes became red hot in the engine exhaust. Although it could not be proved, this incident suggested a possible cause for the unexplained disappearance of a Halifax on a previous operational mission.

The other especially memorable flight, on 14 December 1950, was the first operational sortie using a Hastings aircraft; as flight commander, Bill Mackie acted as captain on this flight. From earlier RAF flying with this aircraft, there had been a suggestion that difficulties might sometimes arise due to what was known as 'oil coring', i.e. the freezing of oil in the engine oil cooler, but before this incident there was nothing concrete to go on. Although in 1950 flights were scheduled as daylight trips, for various reasons take-off on this occasion was delayed so that the climb at the end of the first leg was made in darkness. During the ascent, first one, then two, three and finally all four engines developed dangerous drops in oil pressure due to coring. One of the few advantages of the North Atlantic in winter from the flying point of view is that the sea temperature never falls to freezing point, so there is at least a possibility of coping with serious icing if the aircraft can successfully be brought down to near the sea surface. On this occasion, using the radio altimeter, the aircraft was levelled off at a height of 100 ft above the sea and the sortie was aborted. Fortunately, despite the very low oil pressures on all four engines they continued to function, and after a long period at this low level the frozen ice cores gradually melted and the oil pressures recovered so that on approaching landfall at Tory Island it was safe to climb again for the final leg over land to Aldergrove. Needless to say, this incident led to the introduction of a modification to the engine lubrication system to prevent recurrence.

Postscript

As a practising forecaster during the period of operation of the meteorological reconnaissance flights, I should like to record the gratitude of all forecasters for the fact that these invaluable observations appeared so regularly on our charts; without them, the charts would have been bare indeed to the west of the British Isles. Although at the time the aircrew must sometimes have wondered why they were given these rigid schedules, tracks and flight procedures, there is no doubt whatever about the value of their contribution. I should also like to thank Captain Mackie for the care and patience with which he recalled for me his experiences with the meteorological reconnaissance flights.

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The use by the Meteorological Office of decyphered German meteorological data during the Second World War

By R. P. W. Lewis

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Summary

An account is given of some aspects of the interception and decypherment of broadcast meteorological data from Axis-occupied Europe during the Second World War and how these data were used by the Central Forecasting Office of the Meteorological Office.

The fall of France in June 1940, following the occupation of Denmark and Norway, meant that the supply of meteorological information from most of the continent of Europe to the United Kingdom was cut off, and thus the means were no longer available of constructing the actual and forecast weather charts that were of vital importance for prosecuting aerial warfare. It is a remarkable fact, therefore, that within a year or two British Intelligence was able to supply the Central Forecasting Office at Dunstable with information of such good quality, so fast, that surface and upper-air charts could be plotted, covering the whole of Axis-occupied Europe, that for something like two-thirds of the time were nearly as good as if there had not been a war on at all.

This was principally due to two facts. The first was that German military installations were spread so widely that communications had largely to be conducted by radio transmission and could thus be intercepted, and the second was the skill and devoted hard work of the meteorological section of the Government Code and Cypher School (GC and CS) at Bletchley Park. The work at Bletchley Park has received considerable publicity in recent years, particularly in connection with the decyphering of the German 'Enigma' messages. Many other codes and cyphers were, however, tackled at Bletchley Park, among them the meteorological ones, and success in this latter field had, indeed, important repercussions on the Enigma work.

The precise methods by which the German cyphers were broken have not been explained. One may be certain, however, that laborious persistence in collating days and weeks of broadcast messages known or suspected to be meteorological, and the exploitation of minor weaknesses and blunders on the part of the Germans must all have played a part. It is clear from works such as that by Kahn (1966) that success in code and cypher breaking in real life is very much in line with Edison's description of genius as one per cent inspiration and ninety-nine per cent perspiration.